

## CLAIMS

The following is claimed:

- 1    1.     An adaptive communications system comprising:  
2         a unitary matrix filter; and  
3         a processor configured with logic to adapt the unitary matrix filter to diagonalize a  
4         transmission channel.
  
- 1    2.     The system of claim 1, wherein the processor is further configured with logic to  
2         adapt the unitary matrix filter at a receiver, and then use the unitary matrix filter for  
3         transmission when the receiver becomes a transmitter.
  
- 1    3.     The system of claim 2, wherein the processor is further configured with logic to  
2         use the unitary matrix filter for transmission without feedback from the receiver to the  
3         transmitter.
  
- 1    4.     The system of claim 1, wherein the processor is further configured with logic to  
2         represent a transmission channel as a channel matrix, wherein the processor is further  
3         configured to diagonalize the channel matrix by singular value decomposition.
  
- 1    5.     The system of claim 1, wherein the unitary matrix filter filters symbol vectors  
2         corresponding to a communication signal.

- 1 6. The system of claim 5, wherein the symbol vectors include discrete modulated  
2 signals.
- 1 7. The system of claim 6, wherein the discrete modulated signals are transmitted and  
2 received in an array-to-array communications system.
- 1 8. The system of claim 6, wherein the discrete modulated signals are transmitted and  
2 received in an array-to-array time division duplex communications system.
- 1 9. The system of claim 1, wherein the processor and the logic and the unitary matrix  
2 filter are embodied in a receiver.
- 1 10. The system of claim 1, wherein the processor and the logic and the unitary matrix  
2 filter are embodied in a transmitter.
- 1 11. The system of claim 1, wherein the processor and the logic and the unitary matrix  
2 filter are embodied in a transceiver.
- 1 12. The system of claim 1, wherein the processor and the logic and the unitary matrix  
2 filter are embodied in a cellular phone.
- 1 13. The system of claim 1, wherein the processor and the logic and the unitary matrix  
2 filter are embodied in a base station.

1 14. The system of claim 1, wherein the processor and the logic and the unitary matrix  
2 filter are embodied in a modem.

1 15. The system of claim 1, wherein the unitary matrix filter is defined by a singular  
2 value decomposition of a channel matrix.

1 16. The system of claim 1, wherein the processor is further configured with the logic  
2 to adapt the unitary matrix filter without requiring a training sequence.

1 17. The system of claim 1, wherein the processor is further configured with the logic  
2 to adapt the unitary matrix filter without requiring feedback to a transmitter from a  
3 receiver.

1 18. The system of claim 1, wherein the processor is further configured with the logic  
2 to adapt an estimate of a unitary factor of a singular value decomposition of a channel  
3 matrix.

1 19. An adaptive communications method comprising the steps of:  
2 receiving a signal; and  
3 adapting a unitary matrix for filtering the received signal.

- 1 20. The method of claim 19, further comprising the step of filtering a transmitted  
2 signal with the unitary matrix.
- 1 21. The method of claim 20, wherein the step of filtering is performed without  
2 feedback about the received signal.
- 1 22. The method of claim 19, further comprising the steps of representing a  
2 transmission channel as a channel matrix and diagonalizing the channel matrix by  
3 singular value decomposition.
- 1 23. The method of claim 19, further comprising the step of representing the signal as  
2 symbol vectors corresponding to a communication signal.
- 1 24. The method of claim 23, wherein the symbol vectors include discrete modulated  
2 signals.
- 1 25. The method of claim 24, wherein the discrete modulated signals are transmitted  
2 and received in an array-to-array communications system.
- 1 26. The method of claim 25, wherein the discrete modulated signals are transmitted  
2 and received in an array-to-array time division duplex communications system.

- 1 27. The method of claim 19, further comprising the step of implementing singular  
2 value decomposition processing without feedback from a receiver to a transmitter.
- 1 28. The method of claim 19, further comprising the step of defining the unitary matrix  
2 by a singular value decomposition of a channel matrix.
- 1 29. The method of claim 19, wherein the step of adapting further includes the step of  
2 adapting the unitary matrix without requiring a training sequence.
- 1 30. The method of claim 19, wherein the step of adapting further includes the step of  
2 adapting the unitary matrix without requiring feedback to a transmitter from a receiver.
- 1 31. The method of claim 19, wherein the step of adapting further includes the step of  
2 adapting an estimate of a unitary factor of a singular value decomposition of a channel  
3 matrix.